

Supplemental Specification for implementing DuraSquirt DTIs in accordance with RCSC 2.6.2:
Alternative Washer Type Indicating Devices

DuraSquirt DTIs, (DS-DTI) are enhanced versions of ASTM F959¹ DTIs that render feeler gages unnecessary. DS-DTIs are to be installed in accordance with the following as per the RCSC-2014.

Verification Testing

The DS-DTI with the nut, bolt and washer (forming an assembly) shall be verified to achieve at least the minimum design tension by the bolting crew and inspector; employing the following procedure:

1. Tighten 3 assemblies in a tension calibrator until the DS-DTI displays squirt indication beyond the outer diameter in all bump locations, known as complete indication.
2. Record the achieved tensions, compared to RCSC Table 7.1.

A tension that is greater than the value in table 8.1 is not cause for rejection when using ASTM, and similar hardware. The ultimate shear strength of a bolt is not affected by the pretension in a bolt (Kulak et al., 1987, pp 47).

Installation

Assemblies shall be installed (per connection) by the following procedure and referenced RCSC sections:

1. Insert and snug assemblies in accordance with the requirements of Section 8.1, with the DS-DTI positioned per Figure C-8.1 and washers by RCSC Section 6. If complete indications of the DS-DTIs are achieved while snugging, the identified assemblies shall be replaced.
2. Assemblies are then to be fully tensioned from the most rigid part of the joint onward until complete indications are achieved.

Inspection

Routinely inspect DS-DTIs assemblies by the following procedure:

1. Observe the verification testing and adherence to the snug step of installation.
2. After tensioning, confirm complete indication of inspected assemblies. No further evidence or investigation is required in these cases.
3. When prevailing installation methods are employed to reduce the DS-DTIs bumps to nil, inspection ratios of complete indication less than 100% may be accepted by the site.²

Arbitration

Assembly installation and inspection may be arbitrated by the bolting crew and inspector by:

1. Tightening 3 assemblies in a tension calibrator until the tension calibrator indicates the minimum value specified in RCSC Table 7.1
2. Recording the number of locations where indication media appears beyond the outer diameter of the DS-DTI. The count of indications then forms the minimum for the arbitrated installation and inspection criteria.²

¹ ASTM F959 3.1.1 *compressible-washer-type direct tension indicator*, *n*—washer-type element inserted under the bolt head or hardened washer, having the capability of indicating the achievement of a required minimum bolt tension by the degree of direct tension indicator plastic deformation. Hereafter referred to as *direct tension indicator*.

² Lack of indication may be caused by oversized holes, poor quality hardware, uncured or excessively thick steel coatings, etc. Contact Applied Bolting Technology at (802) 460-3100 or info@appliedbolting.com for assistance.

RCSC Table 7.1 - 2014

Nominal Bolt Diameter, d_b , in.	Minimum Bolt Pretension for Pre-Installation Verification, kips ^a	
	ASTM A325 and F1852	ASTM A490 and F2280
1/2	13	16
5/8	20	25
3/4	29	37
7/8	41	51
1	54	67
1 1/8	59	84
1 1/4	75	107
1 3/8	89	127
1 1/2	108	155

^a equal to 1.05 times the specified minimum bolt pretension required in Table 8.1, rounded to the nearest kip

Assembly Lot Details

	Bolt	Nut	Washer	DuraSquirt DTI
Manufacturer				Applied Bolting Technology
Lot Number				
Grade				
Finish				
Diameter				
Length		DS-DTI Calibrated Gap		

Verification and Arbitration Results

	Test #1	Test #2	Test #3	Site Inspection Ratio
Assembly Verification Results (Achieved tensions)				
Indication Count for Arbitration (when needed)				